Pallid Sturgeon Fish & Wildlife Proposal 1

Draft of July 22, 2005

Title of Option: PS/FWG 50/50 Proposal 1

1. Description of the Proposal:

a. **Number of Rises**: 2

b. **Flood Control Targets/constraints**: Must be adjustable. Constraints should be reaised as necessary to prevent them from stopping the rise.

c. **Timing, duration, magnitude, rise and fall rates of First Rise**: This bi-modal spring rise is represented by the 50%tile of the 100 years of discharge record at Gavins Point Dam. Proposed TOTAL magnitude for the first rise is ~64 Kcfs.. Timing needs to occur before initiation of spawning window (e.g.16 degrees) and should occur on the rising limb of the thermograph. Beginning date should be about March 14 (Julian day 74), peaking (2 days) on March 30 (Julian day 90), with a rise of 16 days. The descending limb would fall over 20 days for a total duration for first pulse of 38 days. For the first pulse, magnitude is more important than duration. First pulse will condition spawning habitat.

Start of rise	March 14 (Julian date 74)
Peak of rise	March 30 (Julian date 90)
End date	April 21 (Julian date 111)
Relative rising peak (Kcfs)	40.7 (~63.5Kcfs total peak)
Total pulse duration	38 days

d. **Timing, duration, magnitude of Flow Between Rises**: Dependent on model output and the specifications of **c**. above and **e.** below.

Timing/duration between pulses	April 22 – May 27 (Julian dates 112-148)
Magnitude of flow	~23 Kcfs stable with slight increase

e. **Timing, duration, magnitude, rise and fall rates of Second Rise**: The second rise should start when water temperature (at Sioux City) reaches ~16 ° C (for second time on ascending limb of thermograph). Rise should start on May 27, rise for 19 days to the peak and then descend for 26 days. Duration of the second pulse is important for physical and biological reasons (i.e., habitat creation, egg hatch…)

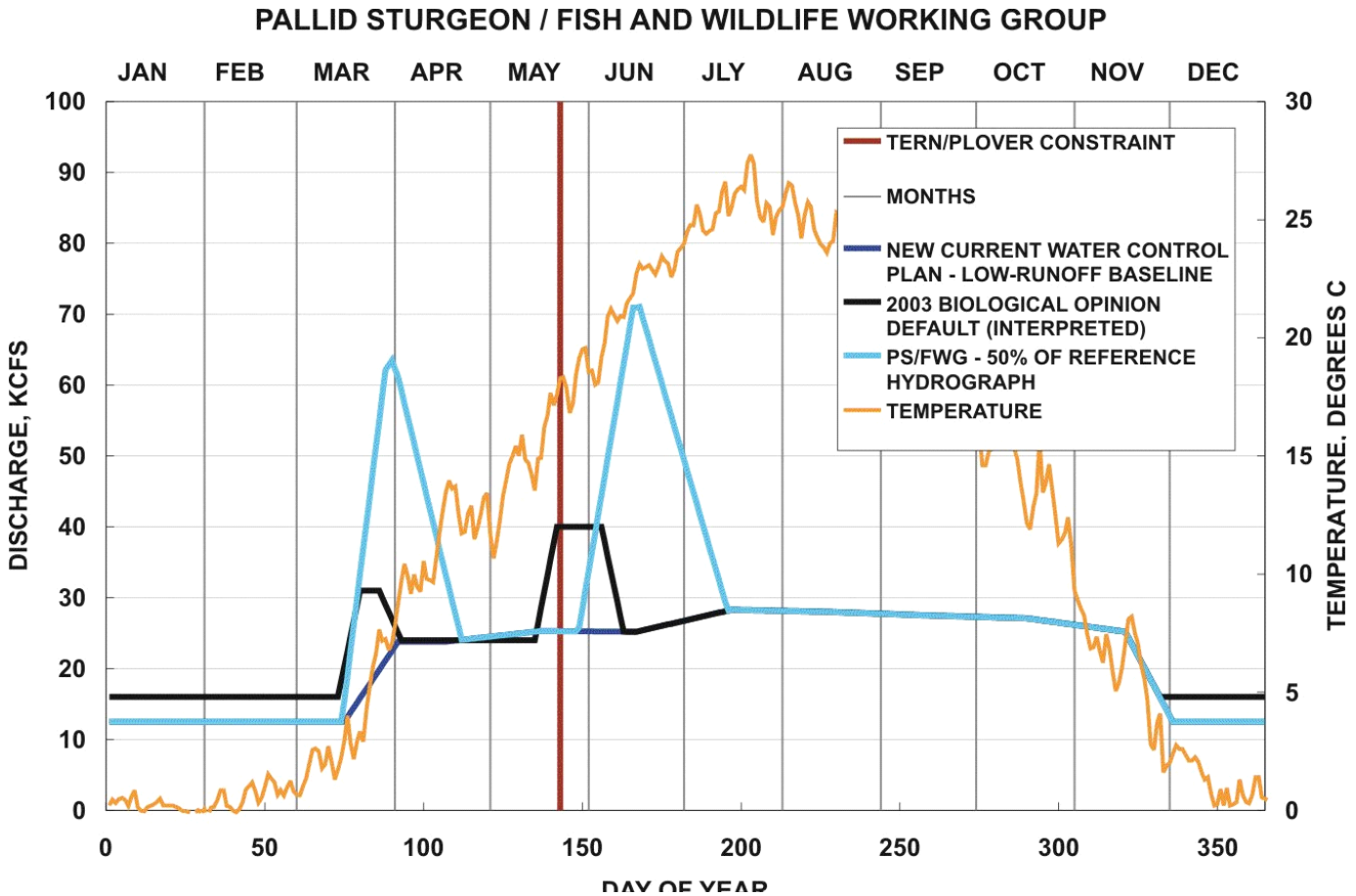
Start of rise	May 27 (Julian date 148)
Peak of rise	June 16 (Julian date 168)
End date	July 13 (Julian date 195)
Relative rising peak (Kcfs)	45.8 Kcfs (~71 Kcfs total peak)
Total pulse duration	47 days

f. How does this address water availability? Variation for wet, normal or dry years (including Stop Protocols or precludes): This proposal uses the 50th percentile of the long term flow record. This proposal uses a peak pulse to address the physical component of the natural hydrograph. This proposal would require that this occur under wetter scenarios than currently exist.

f. **Volume of water used**: This proposal will utilize 3.86 MAF more than the current water control plan.

g. **Level of and purposes for flexibility in its annual application (What is the intended flexibility given to USACE in its application of this proposal?)**: Flexibility exists within magnitude, timing and duration on both rises. Actual amount of water needed for habitat forming flows is uncertain and some flexibility is warranted. As experiment matures and water availability changes different flow scenarios are expected. The specifics of this flexibility will be influenced by what we learn with each new run and the changes that occur within the basin over time.

2. **Hydrograph chart (with sideboards visually noted)**: This proposal is indicated by the dark blue line: PS/FWG - 50% of Reference



3. **Rationale for proposal**:

Biological – The rationale for this proposal is based on the natural hydrograph and our current understanding of *Scaphirhynchus* sturgeon (shovelnose and pallid sturgeons) biology. Timing of the two peaks is based on best available evidence of *Scaphirhynchus* reproductive biology.

The rises in the natural hydrograph are responsible for forming and maintaining spawning habitats. They also historically inundated the floodplain which contributed organic material back to the river. The annual spring rises provided ecological cues for fish spawning and generally maintained the dynamic character of the Missouri River ecosystem. Based on the National Research Council 2000 report and the U.S. Fish and Wildlife Service Biological Opinion, some semblance of these functions needs to be restored to promote recovery of the pallid sturgeon. With that said, there are additional biological benefits spring rises provide. Our spring rise should seek to address/accomplish both the physical and biological functions. Based on current water year constraints, addressing the physical aspects of the rise are not possible this year, but it is what is felt is needed for the species and habitat. Species have adapted to the natural hydrograph and receive biological cues from those flows. These smaller pulses are designed to facilitate reproductive success of the pallid sturgeon. The 1st peak is timed to provide a stimulus for migration and condition spawning habitats (clean spawning substrate). If the 1st peak is high enough and long enough it should stimulate adult sturgeon to begin to migrate and stage (i.e., congregate in spawning aggregations). As we progress towards the second peak, based on flow stimulus and increasing temperature the fish are physiologically and behaviorally getting ready to spawn. The second peak is designed to generate habitat benefits and to coincide with a temperature window conducive to spawning (~18 °C). After the peak, the descending limb will take advantage of the greatest flexibility within the temperature window, providing what we think are beneficial spawning environments. The slowly declining limb promotes spawning, facilitates egg incubation, and dispersal of newly hatched larval sturgeon. There are other community benefits that this flow pattern will facilitate that will provide forage base and general diversity that will be beneficial to the sturgeon.

4. Anticipated effects

a. **Proposal's anticipated effects on, or benefits to, Pallid Sturgeon (how does it assist in flow, timing, temperature, photoperiod, compare with historic hydrograph, comparison with historic flow percentiles, etc):** Our proposal is based on the timing, magnitude, duration, and rate of change of the historical hydrograph within the area of concern, ambient photoperiod, and river temperatures. These factors are universally accepted as critical to reproductive development and successful spawning of riverine fishes, including sturgeons. As we are lacking specific, detailed biological information on exactly what factors affect successful *Scaphirhynchus* spawning this is the most rational approach and

is supported by the scientific literature. The natural hydrograph justifies two rises: the 1st rise is expected to inundate and condition spawning substrate and provide migration cues; the second rise is expected to also inundate and condition spawning substrate, elicit a spawning cue, provide for egg incubation, hatch and larval dispersal. The timing of the proposed second rise is based on our knowledge/understanding of pallid and shovelnose sturgeon reproductive biology in the lower Missouri River and elsewhere. Expected benefits to pallid sturgeon may include: *1st rise* – (1) movement of reproductively mature adults on the first pulse; (2) cleaning of potential spawning substrates; *interval between rises* – (3) movement, staging, and spawning of adults; (4) successful deposition of eggs; (4) incubation of eggs to hatch: *2nd rise* - (5) further cleaning of spawning substrates; (6) movement, staging, and spawning of adults; (7) successful deposition of eggs; (8) incubation of eggs to hatch, and (9) dispersal of newly hatched larvae.

b. **Proposal's anticipated effects on, or benefits to, socio-economic factors (how does this Proposal appear to affect water used in the basin, how to flows attenuate, effect on reservoir levels, navigation impacts, what modeling helps understand the effects)**:

This proposal would have some affects. Modeling is required to clearly identify those impacts.

c. Proposal's anticipated effects on, or benefits to, historic, cultural and burial sites (how does this Proposal appear to affect historic, cultural and burial sites in the basin, what modeling helps understand the effects):

5. Brief description of monitoring methods and indicators:

a. What are the key indicators to be monitored?

Documenting each of the nine expected benefits outlined under 4.a. will be required to evaluate if the proposed spring rise contributes to their reproductive success of shovelnose and pallid sturgeon throughout the lower Missouri River. Ongoing programs that will contribute to this include:

Movement of tagged pallid sturgeon, spawning, congregations of fishes; response of sexually mature shovelnose, are being monitored through the USGS telemetry study. Supporting physiological data are also being collected within this effort. Population monitoring is currently underway throughout the entire reach below Gavins Point Dam and will provide monitoring support for adult and juvenile fish. This effort provides trend information for the population over time. There is also fish and habitat monitoring underway which will provide data on what habitats are used by fishes.

Additional research and evaluation will be required and will be designed as outlined in the next section.

b. **Pending creation of MRRIC, what interim processes should be used to monitor this proposal?** Following this process a group of technical experts should be convened (coordinated by the Corps) to determine the specific monitoring and research objectives that need to be developed, and expanded into study plans. The group should determine the technical skills required to accomplish objectives and acquire the resources necessary to carry out these actions. This needs to be done within the time frame necessary to evaluate the spring rises and provide information back into the process. The success of the spring rise process is dependent on synthesis of the information collected and using that information in an adaptive management frame work to modify this proposal.

   The PS/FWG is currently ranking hypotheses related to evaluating the spring rise and the Middle Basin Working Group has finished the ranking process for recovery of the pallid. The efforts within the Spring Rise need to be closely coordinated with the on going activities within the basin to ensure comprehensive, coordinated management of our actions and the species.

c. **Take the hypothesis developed by this group and provide them to the Middle Basin Pallid Sturgeon Work Group for consideration (e.g., review and comment)**
d. **Develop a priority of these hypothesis**
e. Evaluate the number that are or could be tested under current programs
f. Make recommendations on additional research and funding of the top priorities

Pallid Sturgeon Fish & Wildlife Proposals

Draft of July 22, 2005

Title of Option: PS/FWG Proposal 2

1. Description of the Proposal:

a. **Number of Rises**: 2

b. **Flood Control Targets/constraints**: Yes, they must be adjustable. Raise them as much as is necessary to deter them from stopping the rise in most years.

c. **Timing, duration, magnitude, rise and fall rates of First Rise**: This bi-modal spring rise is represented by the 25%tile of the 100 years of discharge record at Gavins Point Dam . Proposed TOTAL magnitude of the first rise is ~41 Kcfs. Timing of this first pulse needs to occur *before* initiation of spawning window (e.g., ~16 ° C) and on the rising limb of the thermograph.

Start date	March 20 (Julian day 80)
Peak date	March 28 (Julian date 88)
End date	April 9 (Julian date 100)
Relative rising peak, Kcfs	18.0 (~40.5 Kcfs total peak)
Total pulse duration	20 days

For the first pulse, magnitude is more important than duration to condition spawning areas. The ascending limb should occur over 8 days and descending limb should occur over 12 days.

d. **Timing, duration, magnitude of Flow Between Rises**: Dependent on model output and the specifications of **c**. above and **e.** below. General description would be similar to the following:

Timing/duration between pulses	April 10 – May 14 (Julian dates 101-135)
Magnitude of flow	~23 Kcfs, stable to slightly rising

e. **Timing, duration, magnitude, rise and fall rates of Second Rise**: The second rise should start when water temperature (at Sioux City) reaches ~16 ° C (for second time on ascending limb of thermograph). Ramp up for 11 days with a two day peak. The descending limb will ramp out to end when river temperature reaches ~24 ° C for the second time. Proposed magnitude of this scenario is ~50Kcfs. Duration with the second pulse is important for biological reasons (i.e., egg hatch, see biological rationale)

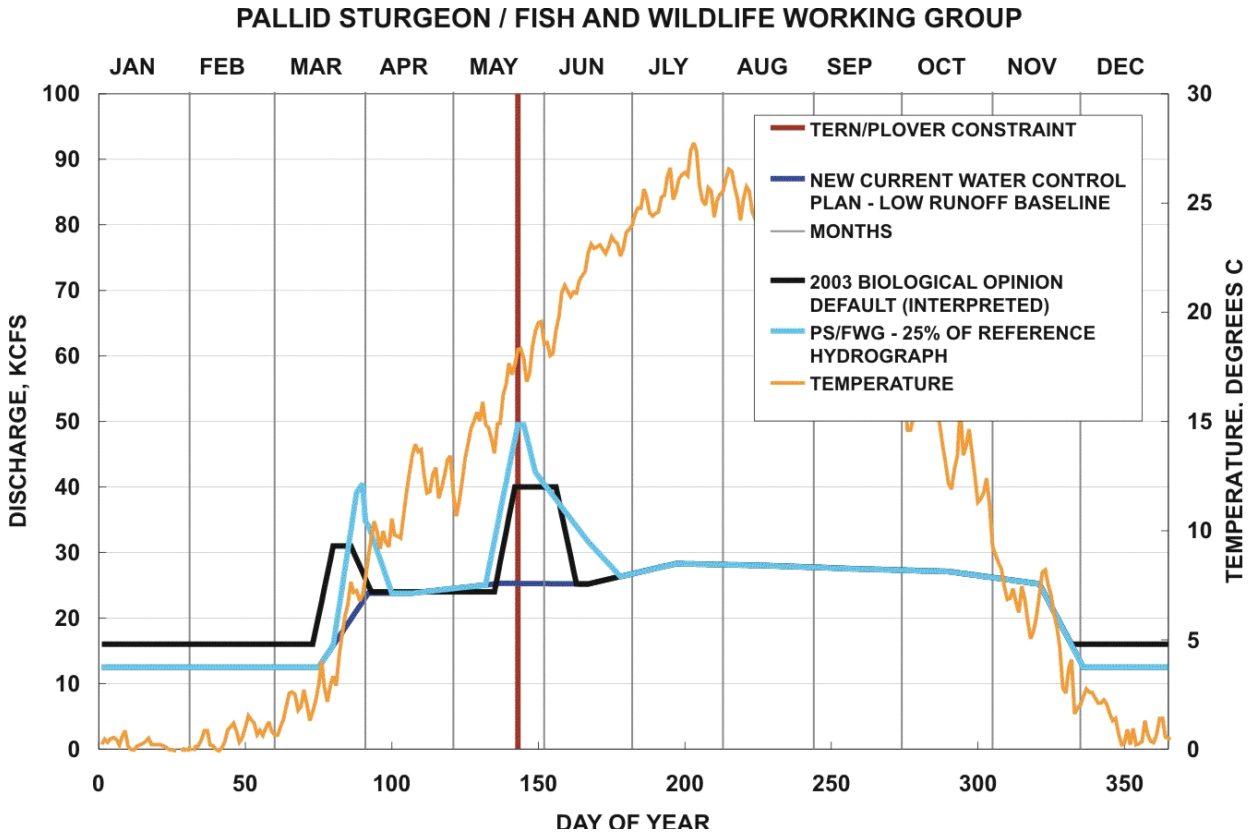
Start date	May 11 (Julian date 132)
Peak date	May 22 (Julian date 143)
End date	June 27 (Julian date 179**)**
Relative rising peak, Kcfs	24.2 (~49.5 Kcfs total peak)
Total pulse duration	47 days

How does this address water availability? Variation for wet, normal or dry years (including Stop Protocols or precludes): This proposal uses the 25 percentile of the long term flow record, an appropriate percentile based on water availability and species needs. This proposal uses a peak pulse rather than a plateau flow, and includes water conservation measures at most points.

f. **Volume of water used**: 1.286 MAF above the current water control plan..

Level of and purposes for flexibility in its annual application (What is the intended flexibility given to USACE in its application of this proposal?): The 25th percentile option provides a considerable reduction in water releases over the preferred 50 percentile option

2. **Hydrograph chart (with sideboards visually noted)**: This proposal is indicated by the green line: PS/FWG - 25% of Reference



3. **Rationale for proposal**:

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The rises in the natural hydrograph are responsible for forming and maintaining spawning habitats. They also historically inundated the floodplain which contributed organic material back to the river. The annual spring rises provided ecological cues for fish spawning and generally maintained the dynamic character of the Missouri River ecosystem. Based on the National Research Council's 2000 report and the U.S. Fish and Wildlife Service's Biological Opinion, some semblance of these functions needs to be restored to promote recovery of the pallid sturgeon. With that said, there are additional biological benefits spring rises provide. This proposed spring rise seeks to address/accomplish both physical and biological functions. Based on current water year constraints, addressing the physical aspects of the rise is not possible this year, but it is possible to address the biological components of the rise. Species have adapted to the natural hydrograph and receive biological cues from those flows. These smaller pulses are designed to facilitate reproductive success of the pallid sturgeon. The 1st peak is timed to provide a stimulus for migration and condition spawning habitats (i.e., clean spawning substrate). If the 1st peak is high enough and long enough it should stimulate adult sturgeon to begin to migrate and stage (i.e., congregate in spawning aggregations). As we progress towards the second peak, based on flow stimulus and increasing temperature the fish are physiologically and behaviorally getting ready to spawn. The second peak is designed to coincide with a temperature window conducive to spawning (~18 °C). After the peak, the descending limb will take advantage of the greatest flexibility within the temperature window, providing what we think are beneficial spawning environments. The slowly declining limb promotes spawning, facilitates egg incubation, and dispersal of newly hatched larval sturgeon. There are other community benefits that this flow pattern will facilitate that will provide forage base and general diversity that will be beneficial to the sturgeon.

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b. **Proposal's anticipated effects on, or benefits to, socio-economic factors (how does this Proposal appear to affect water used in the basin, how to flows attenuate, effect on reservoir levels, navigation impacts, what modeling helps understand the effects)**:

There will be impacts to various entities based on this scenario. In crafting this proposal we considered navigation, interior drainage and terns and plovers, and reservoir storage and worked to minimize those impacts as much as possible.

c. **Proposal's anticipated effects on, or benefits to, historic, cultural and burial sites (how does this Proposal appear to affect historic, cultural and burial sites in the basin, what modeling helps understand the effects):**

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a. What are the key indicators to be monitored?

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Additional research and evaluation will be required and will be designed as outlined in the next section.

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Take the hypotheses developed by this group and provide them to the Middle Basin Pallid Sturgeon Work Group for consideration (e.g., review and comment)

Prioritize revised hypotheses

Evaluate those hypotheses that are or could be tested under current programs

Make recommendations on additional research and funding of the top priorities